Meeting Minutes
Ad Hoc Committee on Amateur Radio Digital Communication
November 11, 1984

1) The following committee members and observers were present at the meeting held in Los Angeles:

Committee Members:

Paul Rinaldo, W4RI, (Chairman)
Marshall Quiat, AGØX (Board Liaison)
Wally Linstruth, WA6JPR
Doug Lockhart, VE7APU

Observers:

Dick Jansson, WD4FAB (VUAC Chairman)
Phil Karn, KA9Q
Larry Kayser, WA3ZIA
Harold Price, NK6K
Keith Pugh, W5IU
Bill Reed, W0ETZ
Bob Stricklin, N5BRG

2) Dick Jansson and Paul Rinaldo reviewed the discussions held with representatives of the Southern California Repeater and Remote Base Association (SCRRBA), which lasted from 8 P.M. Friday (November 9) through about 2 A.M. Saturday morning, concerning the 23-cm band plan. The VUAC-SCRBBA meeting was set up in response to Minute 54 of the ARRL Board October 1984 meeting. When reduced to the main issue, it was a matter of arguing the merits of the VUAC 24-MHz FM repeater offset and that of 12 MHz for SCRBBA. Because the 23-cm band was organized on a grid patterned for 6-MHz-bandwidth TV channels, the practical choices were in multiples of 6 MHz. The VUAC band plan assumed that the wider offset was necessary for affordable duplexers. SCRBBA insisted that a 12-MHz offset was not only practical but in everyday use, even for full-duplex operation in cars. Dick reported that he had agreed to agree on a 12-MHz offset and would sit down with Gordon Schlesinger, WA6BLU, while the Digital Committee meeting was in progress, to sign a memorandum of understanding. (This was done, and a copy of the new VUAC-SCRBBA proposed band plan is included as Attachment A.) Those present at the Digital Committee meeting REAFFIRMED the Digital Committee's stand in September that the digital communications frequencies provided in either the VUAC or the SCRBBA (thus also the new one) would be adequate for development of packet radio.

3) Harold Price reported that Tucson Amateur Packet Radio (TAPR) had completed prototypes of the six-chip serial I/O (SIO) add-on to the Xerox 820 board and that the add-ons would be available from TAPR at the end of November.

4) Phil Karn reported the completion of AX.25 V2.0 software for the Xerox 820 board and its availability on 8-inch disk (source, object and ASCII files). The software supports both channels A and B of the SIO at speeds up to 2400 bauds but might be increased to 9600 bauds with additional work. It is written in Aztec C, supports digipeating, and included hooks for IP (Defense Advanced Research Projects Agency Internet Protocol). Phil invites comments, particularly feedback on the command set.

5) Packet-radio listings in the ARRL Repeater Directory was discussed. At the suggestion of Wally Linstruth, it was RECOMMENDED that digital repeaters be listed in the main part of the directory (in addition to a special listing for digital repeaters) in order to give some visibility to packet frequencies to the voice repeater users. It was RECOMMENDED that substation identifiers (SSIDs) be added to the call signs of packet repeaters listed. There were discussions of other suggestions: a) requesting in Gateway information concerning the main packet-radio frequencies in use in each area, for publication in the Repeater Directory; and, b) development of a code, such as Gateway, Host, and Bulletin board to identify the type of packet-radio facility in the Repeater Directory. Additional information and suggestions for digital repeater listings in the 1985-1986 Repeater Directory should be sent to Paul Rinaldo who will consolidate and pass them to Repeater Directory editor, Jim Clary.

6) At the September meeting, although there was no formal vote taken, the Digital Committee looked favorably on the use of CCITT Recommendations X.3 and X.28, which describe the functions of a packet assembler/disassembler (PAD) or terminal-node controller (TNC) and terminal-to-PAD procedures. Doug Lockhart reported doing additional work since the September meeting. Doug's research on this subject is included as Attachment B. It was AGREED that TNC developers be encouraged to cooperate in standardizing the interface to user terminals. To facilitate this, Doug is to:

a) act as the clearinghouse for this subject,

b) present a paper on this subject at the Fourth ARRL Amateur Radio Computer Networking Conference, and

c) draft a proposed "AX.3/AX.28" protocol (Paul to edit and circulate).

Committee members and others are requested to furnish additional input to Doug as soon as possible.

7) Bob Stricklin suggested the need for a method of testing the bit error rate (BER) of a packet-radio circuit. Paul described the technique used by Bob Bruninga, WB4APR, which involved sending short frames with only the time of day to test a circuit. This was identified as a subject worthy of further study.

8) Paul raised the question of a standard on transceiver turnaround delay. ARRL members have expressed a need for a definition of what is "full break-in" ("QSK") and what is "semibreak-in" since the existence of the transceiver. Transceiver turnaround resurfaced in recent years as the result of packet radio and AMTOR. The sense of those present is summarized as follows:

a) HF-transceiver turnaround times for AMTOR and packet radio should be patterned after AMTOR times which are more critical and fixed.

b) HF-transceiver turnaround times for CW QSK (full break-in) should permit listening for at least half of the interval between Morse code elements at 60 WPM.

c) VHF/UHF-transceiver turnaround times where audio-frequency modems are used can be the same as a).

d) Turnaround times for new VHF/UHF/SHF transceivers for use at speeds of 9600 bauds and higher where radio-frequency modems are used should be about 1 ms.

Paul is to research these turnaround times and prepare a draft for circulation to the committee.

9) There was a discussion of what Amateur Radio equipment manufacturers could do to accommodate packet radio in their products. The following areas were identified:

a) Provide radio equipment audio characteristics, such as frequency response and group/envelope/transmission delay. If the characteristics are generally acceptable, those designing interfaces need to know what amount of compensation is needed. If the characteristics are not acceptable, designers need to know what modifications are necessary to the radios to make them acceptable.

b) Provide rear-panel inputs that bypass microphone amplifiers and outputs that bypass receiver audio circuitry. These ports should operate at fixed levels regardless of settings of front-panel controls.

c) Provide rear-panel I/O ports at intermediate frequencies on VHF and UHF radios for connection of modems operating at speeds of 9600 bauds and higher.

d) Provide for an external high-stability frequency reference for the frequency synthesizer for unattended operation.

e) Consider development of improved modems for all speed ranges and propagation media.

10) There was a brief discussion of the need for a message-transfer protocol. Phil suggested the DARPA Internet Mail Protocol. More study is needed.

11) The feability of developing a large-scale-integration (LSI) chip to handle AX.25 link-layer functions was discussed as a way of reducing the cost of the PAD/TNC function. Several of those present recounted past difficulties encountered by Western Digital and AT&T, and expressed pessimism about the success of an Amateur Radio effort along the same lines.

12) Wally recounted problems with mountain-top packet-radio installations. Concerns center on how to achieve high reliability in this harsh environment and include questions on TNC reset procedures. Wally is interested in "how-to" inputs from anyone with experience.

13) There was a discussion of Digital Committee meetings needed in 1985. The tentative schedule is as follows:

March 30 Saturday	-	Fourth ARRL Amateur Radio Computer Networking Conference, San Francisco
March 31 Sunday	-	Digital Committee meeting, San Francisco
June	-	Digital Committee meeting, Newington
November	-	Digital Committee meeting in conjunction with AMSAT annual meeting (assume Washington, DC)

THE AMERICAN RADIO RELAY LEAGUE, INC.
HEADQUARTERS SOCIETY OF THE INTERNATIONAL AMATEUR RADIO UNION
ADMINISTRATIVE HEADQUARTERS NEWINGTON, CONNECTICUT, U. S. A. 06111

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ARRL COMMITTEE ON AMATEUR RADIO DIGITAL COMMUNICATION

November 15, 1983

To : Members, ARRL Ad Hoc Committee on
Amateur Radio Digital Communication

Info : President Clark
General Manager Sumner

Subject: Results of November 11-13 Committee Meeting

1. The ARRL Ad Hoc Committee on Amateur Radio Digital Communication met on November 11, 1983, in the AMSAT office in Silver Spring, MD. Present were:

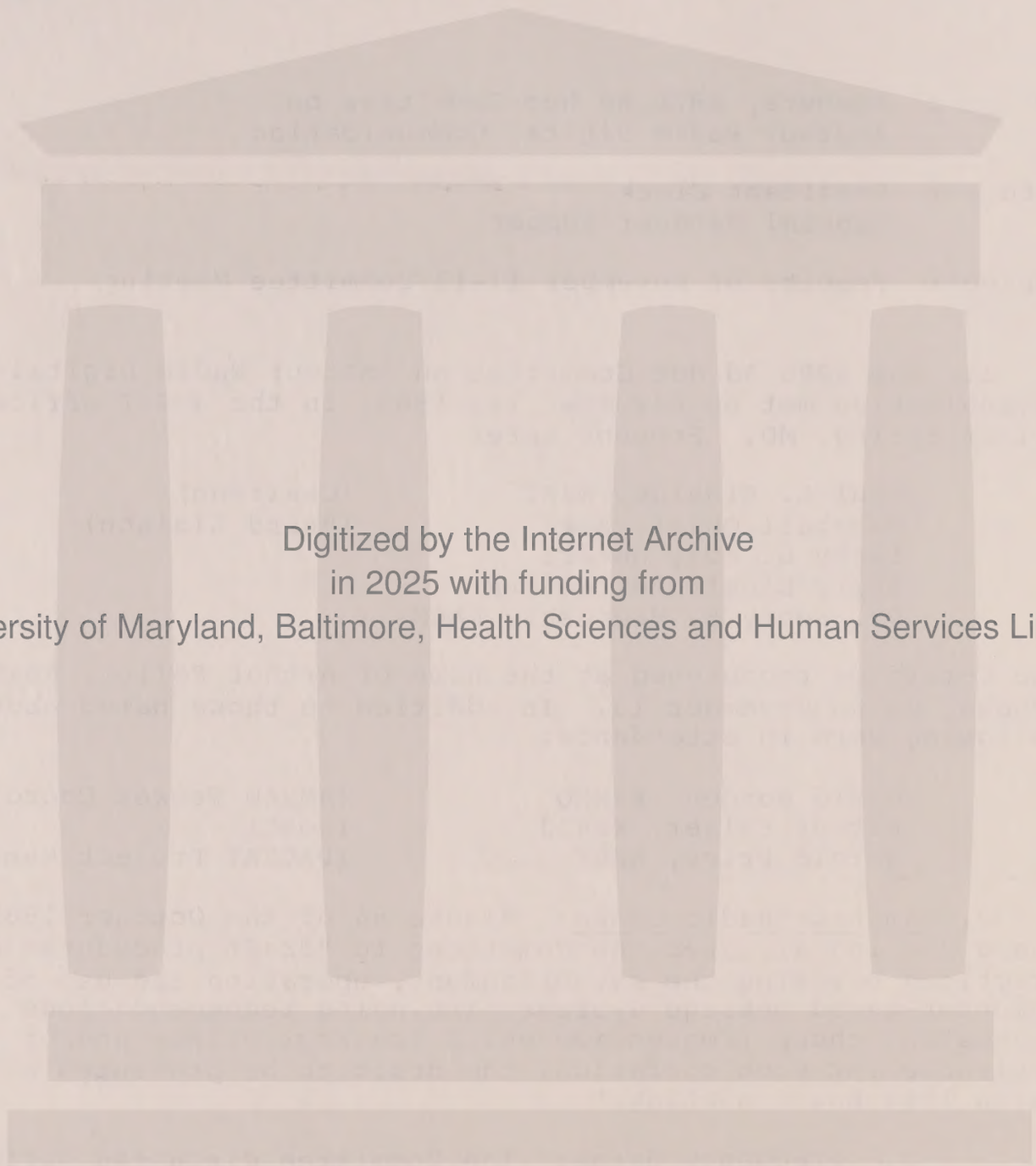
Paul L. Rinaldo, W4RI	(Chairman)
Marshall Quiat, AGØX	(Board Liaison)
Terry L. Fox, WB4JFI	
Wally Linstruth, WA6JPR	
Dr. Henry S. Magnuski, KA6M	

The Committee reconvened at the home of Arthur Feller, KB4ZJ, McLean, VA on November 13. In addition to those named above, the following were in attendance:

David Borden, K8MMO	(AMRAD Packet Coordinator)
Arthur Feller, KB4ZJ	(Host)
Harold Price, NK6K	(PACSAT Project Manager)

2. Amateur Radio CBMSs: Minute 56 of the October 1983 Board Meeting directed the Committee to "draft procedures and practices covering the establishment, operation and use of computer-based message systems, including recommendations suggesting those frequencies which are appropriate and/or desirable for such operation, the draft to be presented at the March 1984 Board Meeting."

a. Frequency Usage: The Committee discussed various alternatives including: (a) allocating channels, (b) devising a band plan, (c) publishing frequencies in use, and (d) letting the users decide, dynamically, by the amount of interference encountered.



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It was agreed that the main thrust should be to (a) solicit information about CBMSs via a QST article as soon as possible (February/March 1984), (b) then publish a frequency list of current RTTY activity, (c) subsequently publish suggested frequency usage.

b. Automatic Operation: The rules do not currently permit an Amateur Radio station to be operated automatically (i.e., without an operator in control of the transmitter and message content at all times) below 29.5 MHz. The Committee discussed whether to seek permission for automatic operation below 29.5 MHz.

It was agreed that Mr. Quiat, as Board Liaison, ask the Board to approve petitioning the FCC for a rule change to permit automatic operation for digital communications providing that:

(1) the control operator shall be responsible for monitoring (it could be passive and must include at least a review of the messages);

(2) the control operator's responsibility includes stopping of improper traffic where possible;

(3) the control operator's responsibility includes warning of offenders; and,

(4) in case of repeater offenses, the control operator's responsibility includes collection of data, transmission to the proper authorities and cooperation in disciplinary procedures.

3. Future Committee Meetings: The Committee agreed to schedule its next meeting on the same weekend as the Third ARRL Amateur Radio Computer Networking Conference, April 15, 1984, at Trenton, NJ. It was also agreed to meet again in late 1984 during the weekend of the AMSAT annual meeting and to plan for a fourth packet conference in March 1985 at the West Coast Computer Faire, San Francisco.

4. Teleport Special Temporary Authority: Several months ago, Mr. Phil Karn, KA9Q, and Dr. Magnuski, KA6Q, questioned whether FCC rules allow stations to act as a relay between terrestrial packet networks and the OSCAR 10 satellite. Messrs. Perry Williams, W1UED, and Rinaldo, then approached FCC/PRB. Mr. Foosaner, Chief, PRB, said that the rules were not written with this type of operation in mind, that he thought this was a good idea, but that an STA would be needed until the rules could be changed. The Committee reviewed a (Clift/Rinaldo) draft of the proposed STA request and agreed with the wording provided that permission to operate Mode A is added.

5. Draft of 160-Meter RTTY Petition: The Committee reviewed the draft of the petition to authorize digital communications in the 1800-2000 kHz frequency band which was sent by facsimile to Counsel Imlay on November 8, 1983 for finalization, in accordance with Minute 51 of the October 1983 Board Meeting. The Committee agreed with the wording.

6. AMTOR Timing Problems: The Committee was briefed on reports that not all of the AMTOR equipment manufacturers are using compatible timing sequences due to different interpretations of CCIR Rec. 476-2 or -3. Committee member Mr. Paul Newland, AD7I, has advised that he is devising a delay-line system to permit the ARRL lab to test various AMTOR units for compatibility over varying HF path lengths.

7. Emergency Applications of Packet Radio: Mr. Linstruth stressed the potential importance of packet radio for emergency communications. The Committee agreed but felt that more progress with packet-radio development is needed before there can be much impact. Mr. Rinaldo added that Harry Patch, W4RSN, a consultant with Electrospace Systems Inc in liaison with the National Communications System (NCS), suggested that a packet-radio demonstration be included in one of the next NCS-sponsored tests of Amateur Radio emergency communications.

8. Packet-Radio Protocol Issues: In October 1982 there was a meeting of the various U.S. packet-radio groups, at the invitation of AMSAT for the purpose of finessing an agreement on a link-level protocol. AMSAT President Dr. Tom Clark wanted to bring about a common protocol so that the different packet-radio groups could be compatible when communicating via OSCAR 10. Mr. Fox (representing AMRAD) proposed a link-level protocol, called AX.25 Level 2, that was modified to accommodate repeater call signs in the frame address field as recommended by Dr. Magnuski (representing PPRS). Those presented agreed to implement this protocol. Within a few weeks, AX.25 Level 2 software was written for the VADCG and TAPR terminal node controller (TNC) boards and distributed to packet-radio users via programmable read-only memory (PROM) chips. Mr. Fox documented the new protocol in a paper that he presented at the Second ARRL packet conference on March 19, 1983. As with any new protocol, there were some problems of interpretation. The problem areas were reported to Mr. Fox (the specification author) by Mr. Price and Dr. Magnuski (the protocol implementors) over the past 12 months. Most ambiguities were resolved, but there remained a number of AX.25 Level 2 issues to be addressed at this meeting:

a. Multihop Repeater Calls: The protocol provides for only one digital repeater to be designated by placing its call sign in the frame address field. The California packet-radio groups met at Mr. Price's residence on July 9, 1983, and agreed on an extension of the address field to accomodate more repeaters to permit explicit routing via a chain of repeaters. This was considered to be a temporary extension of the address field until Level 3 (network layer) protocols agreement is reached. Dr.

Magnuski and Mr. Price reported that they wrote this feature into the latest protocol software for the VADCG and TAPR TNC boards, respectively. It was considered likely that the same feature will be useful in linking a chain of East Coast packet repeaters. The Committee agreed to provide for up to 8 repeaters in the protocol.

b. Information Field Length: There was some confusion over whether the specification of a maximum of 256 octets in the I field were exclusive of the Protocol Identifier (PID), also whether an "even number of bytes" was intended. It was agreed not to count the PID as part of the 256 octets and to specify an integral (not even) number of octets in the I field (i.e., multiples of 8 bits).

c. Permissible ASCII Characters in Call Signs: There was question whether lower-case letters could appear in frame address field call signs. The Committee agreed that only upper-case letters and numerals would be permitted. Implementors should convert any lower-case letters to upper case.

d. Substation Identifiers (SSIDs): There was discussion of a scheme proposed by Mr. Rinaldo for allocating the 16 possible SSID codes (0000 thru 1111) to specific purposes including the user's personal station, host computers, repeaters, auxiliary operation, beacon operation, and teleport operation as a means of identifying these modes similar to /R, /A or /B for Morse-code transmission. After discussion, this scheme was not accepted because it would impose artificial limitations on the maximum number of specific types of operation. It was agreed that the SSID 0000 would be used for the first personal station and the the remaining 15 SSIDs would be assigned solely by the licensee. It was also agreed that to fulfill the station identification requirement, the protocol should recommend that the station originate an information frame containing the call sign of the transmitting station, modifier (such as repeater, beacon, auxiliary or teleport), and other identifying data in plain language in the I field.

e. Self Connection: The protocol does not specify that a self-connection capability is required. This features is written into the existing implementations and was felt to be a necessary one for testing through repeaters or via satellite. It was agreed the the self-connection feature be adopted.

f. Disconnected Mode (DM) Response: There was some confusion on when to send a DM frame. It was agreed to send a DM frame if you receive an SABM frame and cannot connect, also if you receive other than an SABM frame from another station with which you are not connected.

g. Poll/Final (P/F) Bit: The need for the P/F bit was discussed but not resolved. Messrs. Fox and Price will consult their respective CCITT X.25 experts and make a proposal.

9. Finalization of AX.25 Level 2 Specification: The Committee agreed that the changes listed above would complete the AX.25 link-layer protocol. Mr. Fox will make the agreed changes to the protocol specification. Mr. Quiat is to submit the AX.25 Level 2 specification for League adoption at the March 1984 Board Meeting. This is the culmination of two years of work by members of this Committee and others who have contributed to protocol development. It is a significant accomplishment to have a finalized Level 2 protocol based on a year and a half of experience with two successful code implementations written for the VADCG and TAPR TNCs. The practicality of the protocol has been demonstrated on terrestrial VHF, HF and satellite links. It represents a protocol which has been adopted by virtually all packet-radio groups in the United States and has already gained some recognition by packet-radio groups in other other countries.

10. Other Protocol Layers: The Committee plans to address the other protocol layers, particularly Levels 1 (physical layer) and Level 3 (network layer) over the next year. A draft of the Level 1 protocol has been prepared and is in need of revision. It was the sense of the Committee that agreement on a network protocol, while highly important, need not be rushed because there are many other aspects of packet radio to be solved in the near term.

11. California Accord: Dr. Magnuski reported on a meeting held at Mr. Price's residence on July 9 in which all California packet groups were represented. The groups agreed to chain the existing packet-radio repeaters under the name WESTNET. An objective of finding a single simplex frequency for use throughout the state was only partially met. Because of existing occupancy, it was agreed to establish north and south frequencies of 146.58 and 145.36 MHz, respectively, with Mt. Frazier (8013 ft above sea level) as the north-south interface. The Ventura (Red Mountain) repeater will use 145.36 MHz for its WESTNET link and continue to use 224.1/222.5 MHz for its local-area network.

73,

Paul L. Rinaldo, W4RI
Chairman

MEMORANDUM OF AGREEMENT

TO: All Interested Parties DATE: 11/11/1984

FROM: Dick Jansson, WD4FAB
Bill Kelsey, WA6FVC
Wayne Overbeck, N6NB

SUBJECT: 23 CM. BAND PLAN

At the Second Annual Meeting of the ARRL Directors, 26-27 October 1984, discussions of the VUAC-approved 23-cm. band plan were held. A general feeling of the Directors was that further efforts should be made towards reconciling the VUAC bandplan with the plan adopted by the Southern California UHF community on 25 August 1984. For this purpose, the Directors authorized the travels of the VUAC chairman to Los Angeles, CA, for the weekend of 9-12 November, to meet with all interested parties.

The subject meeting was held at the Amfac Hotel, hosted and chaired by Jay Holladay, W6EJJ, and was attended by the amateurs noted in the attached listing. During this 4.5-hour meeting, the following points resulted from the discussions:

1) The SCRRBA-promoted 12 MHz FM repeater offset is 0.94% of the operating frequency and is consistent with the 1.12% offset used on the 440-450 MHz FM repeater band. (For reference, FM repeater offsets used on amateur bands are: 10 meters, 0.68%; 6 meters, 1.88%; 2 meters, 0.42%; 135 cm., 0.72%; 70 cm., 1.12%; 33 cm., 1.31%; 23 cm., 0.94%).

2) Repeater subbands need to be at least 5 MHz wide and also contiguous.

3) Duplexers for 23 cm. repeaters are readily available from Telewave, Inc., for example.

4) The cost of 12 MHz offset duplexers is no higher than the cost of 24 MHz offset duplexers.

5) Wide-bandwidth digital communications interests could not support the need for two 4 MHz segments of the VUAC plan over the 4 MHz and 3 MHz segments provided in the Southern California plan as technology and real needs are not defined at this time.

6) Separate, and isolated, segment assignments for linear translators were not supportable.

7) The lower wide-bandwidth digital segment should be relocated so as to provide a pair of contiguous 2 MHz segments of FM point-to-point links, rather than distributed assignments.

Based upon the discussions held at the meeting, and on the foregoing points of agreement, the VUAC and the SCRRBA representatives concluded that the 23 cm. band plan, attached hereto, appears to be workable. We agreed to submit this plan to our respective organizations for approval as a nationally unified 23 cm. band plan.

Dick Jansson, WD4FAB
Chairman, VUAC

Bill Kelsey, WA6FVC
Tech. Committee, SCRRBA

Wayne Overbeck, N6NB
Vice Director, ARRL

List of those attending 23 cm. band plan meeting, 9 November 1984:

Louis Anciaux, WB6NMT	Member, VUAC
E.R. "Chip" Angle, N6CA	-
Cliff Buttschardt, W6HDO	-
Robin Critchell, WA6CDR	Tech. Committee, SCRRBA
Fried Heyn, WA6WZO	Director, ARRL
Sandi Heyn, WA6WZN	SM, ARRL
Jay Holladay, W6EJJ	Vice President, ARRL
Dick Jansson, WD4FAB	Chairman, VUAC
Bill Kelsey, WA6FVC	Tech. Commitee, SCRRBA
Tom O'Hara, W6ORG	ATV Advisor, SCRRBA
Wayne Overbeck, N6NB	Vice Director, ARRL
Karl Pagel, N6BVU	Member, VRAC
Paul Rinaldo, W4RI	Tech. Manager, ARRL
Gordon Schlesinger, WA6LBV	Secretary, SCRRBA
H. Paul S huch, N6TX	Member, VUAC

ARRL 23 CM. BAND PLAN *

Note: All frequencies are in MHz.

1240 - 1246	ATV #1	(1,2)
1246 - 1248	Narrow-bandwidth FM point-to-point links and digital, duplex with 1258-1260	(1)
1248 - 1252	Digital Communications	(1,7,8)
1252 - 1258	ATV #2	(1,2)
1258 - 1260	Narrow-bandwidth FM point-to-point links and digital, duplexed with 1246-1248	(1)
1260 - 1270	Satellite uplinks, reference WARC 1979	
1260 - 1270	Wide-bandwidth experimental, simplex ATV	(4,5)
1270 - 1276	Repeater inputs, FM and linear, paired with 1282-1288, 239 pairs every 25 kHz, e.g. 1270.025, .050, .075... 1275.950, .975. 1271.0-1283.0 uncoordinated test pair	(1,3,8,10)
1276 - 1282	ATV #3	(1,2)
1282 - 1288	Repeater outputs, paired with 1270-1276	(1,3,8,10)
1288 - 1294	Wide-bandwidth experimental, simplex ATV	(5)
1294 - 1295	Narrow-bandwidth FM simplex services, 25 kHz. channels	(6)
1294.5	National FM simplex calling frequency	
1295 - 1297	Narrow bandwidth, weak-signal communications (no FM)	
1295.0-.8	SSTV, FAX, ACSB, experimental	
1295.8-1296.0	Reserved for EME, CW expansion	
1296.0-1296.05	EME-exclusive	
1296.07-.08	CW, SSB beacons	
1296.1	CW, SSB calling frequency	
1296.4-.6	Crossband linear translator input	
1296.6-.8	Crossband linear translator output	
1296.8-1297	Experimental beacons (exclusive)	
1297 - 1300	Digital Communications	(1,7)

Footnotes:

1) Coordinated assignments required.

2) ATV assignments should be made according to modulation type (for example, VSB-ATV, SSB-ATV, or combinations). Coordination of multiple users of a single channel in a local area can be achieved through isolation by means of cross polarization and directional antennas. DSB ATV may be used, but only when local and regional activity levels permit. The excess bandwidths from such users are secondary to the assigned services.

3) Coordinate assignments with 100 kHz channels, beginning at the lower end of the segment until allocations are filled, then assign 50 kHz channels until allocations are filled before assigning 25 kHz channels.

4) Wide bandwidth experimental users are secondary to the satellite service and may be displaced upon the installation of any new satellites. Users are EIRP-limited to the noise floor of the satellites in service and may suffer interference from satellite uplinks.

*to be proposed to ARRL Board of Directors in January, 1985

5) Simplex services only; permanent users shall not be coordinated in this segment. High-altitude repeaters or other unattended fixed operations are not permitted.

6) Voice and non-voice operations.

7) Consult 47 C.F.R. 97.69 (FCC regulations) for allowable data rates and bandwidths.

8) Provide guard bands at the higher frequency end of segments, as required, to avoid interference to ATV.

9) May be duplexed experimentally with other non-coordinated band segments.

10) Linear translators are recommended for operation in the range of 1274/1286 MHz.

Doc. #22

REPORT OF
THE AD HOC COMMITTEE ON AMATEUR RADIO DIGITAL COMMUNICATION

The Committee met in Los Angeles on November 11, 1984. The Committee discussed results of the VUAC/SCRRBA meeting of November 9 set up in response to Board Minute 54. The Committee advised VUAC Chairman, Dick Jansson, WD4FAB, that the digital communications frequencies in the resultant 23-cm band plan would be adequate for development of packet radio.

At that meeting, the Tucson Amateur Packet Radio group reported completion of a prototype of a serial input-output add-on to the surplus Xerox 820 computer board to permit its use in networking experiments. These add-ons have since become available to experimenters. Phil Karn, KA9Q, completed a Xerox 820 implementation of the AX.25 link-layer protocol, which is also now available.

The Committee encouraged Doug Lockhart, VE7APU, to continue his work on terminal-to-TNC (terminal-node controller) protocols based on CCITT Recommendations X.3 and X.28. There is no present standard on the commands and responses to/from a TNC as seen on the user's terminal.

Transceiver turnaround times (including the age-old problem of what is "QSK" or "break-in") was discussed by the Committee, as this problem affects CW, AMTOR and packet radio. It was concluded that a minimum specified turnaround time of 20 ms should suffice for CW, AMTOR and packet radio where audio modems are used. It was also concluded that a quicker turnaround of 1 ms would be needed for packet-radio circuits that operate at or above 9600 bauds. A proposed standard will be drafted, circulated for technical comment, and (assuming some support) will be presented to the Board for consideration.

Since the November 11 meeting, some progress has been made by several groups on networking concepts, but there has not been sufficient time for on-the-air networking experiments.

Copies of the AX.25 Amateur Packet-Radio Link-Layer Protocol document were received from the printer on January 22, 1985, and are being distributed.

There has been widespread acceptance of the AX.25 protocol, not only among U.S. packeteers, but by those in the U.K., the Federal Republic of Germany, New Zealand, South Africa, and Japan. The only groups we know of that remain reluctant to accept AX.25 are the Australians and certain parts of Canada following the Vancouver V2 protocol.

Several packet-radio stations in the Northeast (including W1AW) are now using experimental software for automatic forwarding of messages between bulletin boards. Software now exists for exchanging traffic in the National Traffic System message format.

Digital Committee meeting plans for 1985 are as follows:

March 30 - Fourth ARRL Amateur Radio Computer Networking Conference, San Francisco

March 31 - Digital Committee meeting, San Francisco

June - Digital Committee meeting, Newington

November - Digital Committee meeting in conjunction with AMSAT annual meeting (assume Washington, DC)

Respectfully submitted,

Paul L. Rinaldo, W4RI
Chairman

-PR

FILE CO

Before the
FEDERAL COMMUNICATIONS COMMISSION
Washington, D.C. 20554

In the Matter of	)	
	)	
Amendment of the Rules Governing	)	
the Amateur Radio Service to	)	RM-
Permit Automatic Control of	)	
Amateur Digital Communications	)	

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Office of the Secretary

PETITION FOR RULE MAKING

The American Radio Relay League, Incorporated (the "League"), the national association of amateur radio operators licensed by the Commission, hereby respectfully requests that the Commission amend its rules by the addition of a new Section 97.80 to permit automatic control of digital communications on all amateur frequencies above 30 MHz, provided that certain safeguards are incorporated in the amateur station as control functions. As support for this request, the League states as follows:

1. Present Commission Rules at Section 97.79 provide (a) the licensee of an amateur station shall be responsible for its proper operation; and (b) every amateur radio station, when in operation, shall have a control operator. "The control operator shall be present at a control point of the station except when the station is operated under automatic control. (Automatic control is only permitted where specifically authorized by the

Rules of this part)..." There are provisions[1/] for automatic operations of repeater and auxiliary stations and beacon operation, but there is no such provision for routine amateur communications utilizing digital codes under automatic control.

2. There are now in place at Section 97.69 of the Rules detailed provisions for use of digital communications in the Amateur Radio Service. That section specifies, in part, that

> These digital codes may be used for such communications as (but not limited to) radio teleprinter and other objects, transference of computer programs or direct computer to computer communications, and communications in various types of data networks (including so-called "packet switching" systems);...

These types of digital communications, especially since the advent of request-repeat radioteleprinter systems such as AMTOR,[2/] can be done with a great deal of reliability without a control operator present. Amateur stations, utilizing present microprocessor and computer technology now routinely present at amateur stations, can automatically transmit and receive digital communications, verify receipt of messages, and respond when inquired of. The use of Computer Based Message Systems is a new aspect of

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1/ See Section 97.85(e) regarding automatic control of repeater operation and Section 97.86 regarding automatic control of a station in auxiliary operation when part of a system of stations in repeater operation is operated under automatic control.

2/ See Order, RM-4122, FCC 83-36, 53 RR 2d 109 (1983), permitting the use of AMTOR in the Amateur Radio Service.

amateur communications which should be encouraged, consistent with establishment of standards for good amateur operating practice. Consistent with procedural safeguards to prevent malfunctions from continuing during unattended automatic operations of amateur stations, the level of amateur experimentation with digital communications has progressed to the point that automatic control of digital communications is both feasible and necessary to facilitate further development of such experimentation.

3. Therefore, the League requests that a new Section 97.80 be established, immediately following the control operator requirements of Sections 97.79 in Subpart D of the Rules governing Operating Requirements and Procedures, to permit automatic control of an amateur station on frequencies above 30 MHz[3/] when utilizing digital communications as defined by and in accordance with Section 97.69 of the Rules. Such automatic operation would be subject to the inclusion of adequate circuitry to assure (1) the detection of transmitter malfunction and, upon detection thereof, automatic transmitter shutoff; (2) the capacity to prevent transmission of improper message traffic, such as business communications; (3) means to prevent transmission while the channel is occupied; and (4) compliance with all other applicable technical and operational standards for amateur radio stations.

3/ Given the heavy use of HF frequencies, it is believed that manual control for digital communications is more appropriate.

4. Of course, the authority to utilize automatic control of digital communication would not alter the primary responsibility of the station licensee for proper station operation. The League Board of Directors has adopted interim standards for good amateur practice for digital communications, and specifically for establishment and operation of computer-based message systems in the Amateur Radio Service. The promulgation of such guidelines will assist in assuring responsible use of the automatic control sought by this Petition. They are as follows:

Establishment of New Systems

New CBMSs should serve a need within the basis and purpose of Amateur Radio as stated in Section 97.1 of the FCC rules and not simply add to congestion by duplicating services already available.

Frequencies should be selected in accordance with the ARRL band plans.

VHF and UHF channels should be coordinated with the appropriate frequency coordinator(s).

Frequencies in the HF bands should be time-shared with existing CBMSs to the extent possible in coordination with the other CBMS operators using that same frequency.

Where sharing of an existing frequency is not feasible, new channels should be selected near the upper portion of the particular RTTY subband, leaving the lower parts of the RTTY subband to DX and other operator-to-operator QSOs.

Operational Safeguards

CBMSs should listen before transmitting. The system should sense activity on the channel and not transmit until the channel goes free. This can be accomplished by a carrier-detect circuit.

Incoming messages should not be retransmitted until read and released by the CBMS operator.

Until such time that the FCC permits unattended automatic operation of HF CBMSs, CBMS operators should monitor their transmissions (at least aurally) at all times that the CBMS is on the air and have a reliable method of terminating transmission in the event of malfunction. Monitoring may be done from a remote location.

The system should have software provisions to limit specific responses to a maximum of 10 minutes. Longer responses should be interrupted at least every 10 minutes for a go-ahead from the other station.

The system should have a hardware "watchdog" timer to limit individual transmissions to 10 minutes.

In order to make the channel available to other stations, CBMS operators should cull files that are out of date and offer user instructions for an s.a.s.e. by mail.

A CBMS operator should establish and make public a policy regarding acceptance of borderline traffic such as that relating to sale of equipment after reviewing current FCC rules and interpretations.

User Operating Practices

Monitor the frequency for a short period before calling a CBMS.

Do not interrupt another station using a CBMS.

Do not interfere with a QSO on or near the frequency.

Always properly identify your station.

Keep your signals on frequency.

Do not list "for sale" items without prior permission of the CBMS operator.

Make sure that you deactivate the CBMS by using that system's correct EXIT command.

5. The Commission has twice[4/] recently emphasized its objective of encouraging new technologies in the Amateur Service, balanced against assuring enforcement capability. In this context, no enforcement problems are created by the proposed rule change. Yet, the added authority would greatly facilitate and encourage amateur digital experimentation and increase communications effectiveness.

WHEREFORE, the foregoing considered, the American Radio Relay League, Incorporated respectfully requests that the Commission amend its Rules by the addition of the proposed Section 97.80, attached as Appendix A, to permit automatic control of digital communications in the Amateur Radio Service on frequencies above 30 MHz, subject to the operational safeguards specified therein to assure rule compliance and preclude interference.

Respectfully submitted,

THE AMERICAN RADIO RELAY
LEAGUE, INCORPORATED

By: Christopher D. Imlay
Christopher D. Imlay, Its Counsel

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November 14, 1983

4/ See Order, FCC 83-36, 48 Fed. Reg. 7457, 53 RR 2d 109 (1983) and Report and Order, "Digital Code Usage in the Amateur Radio Service," FCC 82-413, 52 RR 2d 397 (1982).

APPENDIX

Section 97.80 Automatic Control of Digital Communications.

Amateur Radio Stations may be operated under automatic control on frequencies above 30 MHz when utilizing digital communications pursuant to Section 97.69, provided that the control functions include (i) adequate provision for detection of transmitter malfunction and discontinuance of transmitter operation in the event such malfunction is detected; (ii) devices installed and procedures implemented to ensure compliance with the rules when a duty control operator is not present at a control point of the station. Upon notification by the Commission of improper operation of a station under automatic control, operation under automatic control shall be immediately discontinued until all deficiencies have been corrected.

FEDERAL COMMUNICATIONS COMMISSION
WASHINGTON, D.C. 20554

October 18, 1984

IN REPLY REFER TO:

7230-D

Mr. Paul L. Rinaldo, Manager
Technical Department
The American Radio Relay League, Inc.
225 Main Street
Newington, Connecticut 06111

Dear Mr. Rinaldo:

This is in reply to your letters of August 6, September 26, and October 5, 1984 in which you request certain amateur radio rule waivers and temporary authorization for teleport operation.

We have reviewed your request and have concluded that the automatic relaying of digital messages between amateur stations on earth and amateur satellites via intermediary stations (stations in teleport operation) may contribute to the advancement of the technical and communication aspects of the art of radio.

The details of the waivers granted and the particulars of the temporary authorization are shown below. Section 405 of the Amateur-Satellite Service Rules does not require a waiver since the applicable rules in Subparts A through E of the Amateur Radio Service rules have been waived.

§97.126 (a) is waived to permit an amateur station engaged in teleport operations to retransmit automatically the radio signals of other amateur radio stations.

§97.126 (b) is waived to permit a remotely-controlled amateur station engaged in teleport operations to communicate with stations which are not shown on such station's system network diagram.

§97.79 (b) is waived to permit an amateur station engaged in teleport operations to be operated under automatic control without the presence of a control operator at a control point of the station; provided that devices are installed and procedures implemented to ensure compliance with the Commission's rules at all times; and, provided further that upon notification by the Commission of improper operation of a teleport station under automatic control, such automatic control shall be discontinued immediately until all deficiencies have been corrected.

In view of the foregoing rule waivers, temporary authorization is granted to the licensees of the following amateur radio stations:

WD4IWG	WA9FMQ	KØCY
K1KSY	WB6YMH	NK6K
W3IWI	WA7GXD	WDØETZ
KD2S	KA9Q	WB5YFU
N5AHD	WA2LQQ	N5BRG
W1HDX	W1AW	N2EKH
KE6ZE	KA6M	N6IIU

Teleport operations may be conducted on the following frequencies:

Satellite uplink and downlink: 144-146 MHz
435-438 MHz*

Terrestrial inputs/outputs: Any amateur frequency at 50 MHz and above where digital communication is permitted. Operation must comply with § 97.69 of the Commission's rules.

*Stations operating in the Amateur-Satellite Service shall not cause harmful interference to other stations between 435 and 438 MHz (See international Radio Regulations, RR 664).

Except for the rules herein waived, the licensees of the stations listed above shall comply with all applicable rules in Subparts A through E, Amateur Radio Service; and, with all applicable rules in Subpart H, Amateur-Satellite Service.

This temporary authorization shall expire 180 days after the date of this letter. (See Section 1.925 (a) of the Commission's Rules.)

Sincerely,

Robert S. Foosaner
Chief, Private Radio Bureau

cc: Dr. Thomas A. Clark
The Radio Amateur Satellite Corporation
850 Sligo Avenue
Suite 601
Silver Spring, Maryland 20910

Douglas Lockhart, VE7APU
Vancouver Amateur Digital Communications Group (VADCG)
9531 Odlin Road,
Richmond, B. C.
Canada V6X 1E1

This is documentation for the fifth test implementation of the V-2 protocol for the VADCG Terminal Node Controller. This version is dated November 4, 1984. The major changes are in the TIP. Since test version 2, the previous command structure has been almost completely replaced by an interface based on the X.3 protocol a copy of which has already been sent to testing sites. This version completely obsoletes all earlier test versions and those versions should be destroyed.

The full-duplex mode of V-2 is still not in place in this test implementation. However, a facility to ignore carrier sense has been installed. This will facilitate operation in environments which cannot provide a reliable carrier sense indication. To activate this facility set parameter 31 to 1. To deactivate it, set parameter 31 to 0. Full-duplex will likely be provided in the next test implementation.

The TIP program has been improved as well with the elimination of a few more commands whose function was included in the X.3 protocol. Also, all the configuration information is contained in a contiguous area near the beginning of the first TIP EPROM. This was done to facilitate the production of EPROMs for different users without requiring an assembly on a CP/M system. The EPROMs may be copied and the necessary changes can be made in the first TIP EPROM only.

This test implementation, like the second, has only been given rudimentary on-the-air testing and all of the new facilities need further testing. Please put it through its paces and send a report on the problems and any deviation from the V-2 specifications back to me and I will attempt to fix them.

This implementation of V-2 is for the VADCG TNC but will only run on one which has been converted to 2716 or 2732 EPROMS. This is due to the size of the code which is more than the capacity of the 2708s.

This implementation uses the unusual address space created by the TNC modifications to support 2716 OR 2732 EPROMS as described in the file MEMORY.MOD also found on the distribution diskette. In particular it uses the hardware wraparound type RAM addresses to facilitate management of the circular buffers. For this reason, it may not run in TNCs modified in a different way. Also, it will not run in the Ashby TNC unless it has a PAL which duplicates one of the address spaces created by the modification. This software has not been tested in the Ashby TNC and it may require other changes to run in the Ashby TNC. I would appreciate feedback from anyone using this software in an Ashby TNC.

If you have any improvements, modifications, or gripes related to these programs, send your input to the VADCG address, and I will try to respond.

THE DISTRIBUTION DISKETTE

The distribution diskette is a SSSD CP/M 8-inch diskette containing the following files:

```
LIPTT2.ASM
NIP.ASM
TIPTT2.ASM
CIPTT.LIB
CONFIG.LIB
TNCDUMP.ASM
READ.ME
MEMORY.MOD
SEQIO.LIB
```

NOTE: The .ASM files are intended to be assembled with the Digital Research MAC assembler.

FILE DESCRIPTION

LIPTT2.ASM - This is the assembly file for the V-2 LIP (Link Interface Program) which is basically the ISO datalink layer software. Also called ISO level 2. It resides at address 0 in the TNC and requires two 2716s or one 2732 to contain it. All of the V-2 protocol is in this program.

NIP.ASM - This is the assembly file for the NIP (Network Interface Program) which is where the ISO network layer software will reside (Level 3). This implementation does not have a true network layer and basically the only function this code performs is the insertion of a dummy network header in outgoing frames. The V-2 network layer specifications have not been published yet although they are nearing finalization. The default NIP program resides at address 0D00H in the TNC and shares the 2nd 2716 or 1st 2732 with part of the LIP program.

TIP.ASM - This is the assembly file for the TIP (Terminal Interface Program) which is the program which communicates with a terminal or with a computer simulating a terminal. It drives the 8250 serial interface and presents the data and status messages to the terminal in a form which can be used. Commands from the terminal are interpreted by the TIP and data from the terminal is converted to a form the TNC can use. From the point of view of the ISO layer structures this software would in general be layer 6 - the presentation layer. Levels 4 and 5, the transport and session levels do not really exist in this implementation of V-2. I expect that another presentation layer program for communication with computers (rather than computers simulating terminals) will be available soon. It can replace the TIP code for users wishing to communicate with a computer. It will be called the HIP (Host Interface Program). The TIP default starting address is at location 1000H in the TNC and requires one 2732 or two 2716s to contain the code.

CIPTT.LIB - This file contains the equates and macros common to the above programs and defines the layout of the common communications area (CCA). It must be available during the assembly of the above programs.

CONFIG.LIB - This file contains the configuration information which goes into the TIP. It is separate from the TIP program because the small file is more convenient to modify than the entire TIP program. It must be available during the assembly of TIPTT2.

TNCDUMP.ASM - This assembly file is a CP/M program which captures a trap dump from the TNC and formats, displays and/or prints the contents of the TNC memory. It will also format and display the contents of the 8085, 8250 and 8273 registers at the time the TRAP interrupt was taken. Version 2 contained on the diskette also has the facility to write the dump onto the diskette to be

retrieved from the diskette at a later time for analysis. The storage dump saved on the diskette could possibly be delivered to someone who could better analyse the problem. It is used for analysis of problems in the TNC. To use it, you must first have a CP/M system with a serial port. You will most likely have to change some of the equates and instructions for the serial port and possibly the clear screen instructions which may not work for your terminal. Make sure the UARTM and DIVISOR equates in CONFIG.LIB match those set in the TNCDUMP program. A cable from the CP/M serial port and the TNC terminal port will also have to be made up. To use it, hit the TRAP switch on the TNC and then type "TNCDUMP" after connecting the cable. The program will prompt for additional input.

READ.ME - This documentation file. Print this file first.

MEMORY.MOD - This is a documentation file containing information on the hardware modifications to the VADCG TNC to support 2716 or 2732 EPROMs. This V-2 implementation requires the TNC to be modified in this way.

SEQIO.LIB - This is the sequential file I/O macro library for the MAC assembler. This file must be accessible during the assembly of the TNCDUMP program.

SUGGESTED INSTALLATION PROCEDURES

1. Modify the VADCG TNC for 2716 or 2732 EPROMs as per the instructions in the file, MEMORY.MOD.

2. Edit CONFIG.LIB as necessary to set up the initial defaults. Note that all but the monitor defaults may be changed from the keyboard if necessary as long as the terminal Baud rate and format are correct. The default UART specification without AutoBaud are at labels ISERFM and ISERSP. The UART specification for the trap monitor 'H' command are found at labels UARTM and DIVISOR. The node name at label 'INNAME' will very likely need to be changed.

3. Edit CIPTT.LIB to change the EPROM equate for either 2716s or 2732s. The distributed version of CIPTT.LIB is set up for 2716s.

4. Assemble the LIPTT2, TIPTT2 and NIP files.

5. Burn the NIP.HEX, LIPTT2.HEX and TIPTT2.HEX files into the 2716 or 2732 EPROMs.

6. Install the EPROMs in the TNC in the proper locations, hook up the terminal, modem and power up the TNC and cross your fingers.

The necessary equates to configure TIPTT2 are contained and explained in CONFIG.LIB. The call sign must be seven characters (pad on right with spaces if necessary). Note that all values set in the CONFIG.LIB file are initial values only, and may be changed from the keyboard or computer after power up.

ALL PARAMETERS REVERT TO THOSE INITITALIZED IN THE PROMS EVERY TIME THE RESET BUTTON IS PUSHED OR WHENEVER THE TNC IS POWERED ON.

Before a terminal or terminal emulation program may use the serial interface on the TNC, the speed and format of both the TNC and terminal must match. This TNC software does not have any user commands to set the speed and format of its serial interface but does support two other methods to accomplish this.

Method #1 - If X.3 parameter 31 default value is 0, the TNC will use the default speed and format burned into the TIP EPROM locations ISERFM and ISERSP. If this is the case, you will get the initial sign-on message on the terminal every time the TNC is reset, assuming your terminal is set up to this speed and format.

Method #2 - If X.3 parameter 31 default value is 1, the TNC will use AutoBaud (also called Autospeed) to match the terminal's speed and format. When the TNC is reset, you will not automatically get the initial sign-on message on your terminal and it will be necessary to send a series of service signals to the TNC to allow it to determine the speed and format of the terminal. The service signals consist of alternately sending a period '.' and a comma ',' to the TNC on the serial interface. The period and comma should be alternated until the initial sign on message appears, followed by a command prompt. Almost all common terminal speeds and formats are supported. If your terminal uses a very unusual speed or format, you may have to use method #1. For further information on which speeds are supported look at the description of X.3 parameter 11 near the end of this document. The initial sign on message is in the following format:

```
VADCG V-2 TIP xxxxxx
*
```

where 'xxxxxx' represents a date when the software was last changed.

The '*' prompt will only appear if command mode is permitted and prompt signals are allowed. See X.3 parameter numbers 1 and 6.

The Command structure:

The command structure has been radically changed from the second test implementation. Most of the functions are controlled by the 'SET' command now and almost all the old 2 letter commands are non-functional. Most but not all the X.3 parameters are functional. The non-functional commands have been deleted from the following list.

The TIPTT2 program has a set of commands that allow a user to change the operating parameters of the TNC, to link and unlink from other stations, or to reset the TNC from the terminal or computer connected to it. Commands to control the functioning of the datalink and network layer programs are also provided.

It is no longer required to only issue a command at the beginning of a packet. The issueing of a command automatically closes off any partial packet. The commands are semi-transparent now. If you wish to send the command escape character as data, then type it twice and it will be sent once.

The format of a command is:

<ESCHAR><command> <operand><CR>

where:

<ESCHAR> is the current Command escape character (X.3 parameter 1) which defaults to ESC in distribution versions of CONFIG.LIB,

<command> is a command from the table following,

<operand> is the data to be used by the command, if required (see below). Some commands have no operands and others require one or more.

For example, to set the Call Sign of the station to VE7ABC, type:

<ESC>CA VE7ABC<CR>

Note: the angle brackets < and > are used to enclose a single character for visual purposes only. You don't type them, just the single character defined within them, for instance, you hit the carriage return key, not <, then carriage return, then >.

No spaces are allowed between the <DCCHAR> and the command. At least one space is required to separate the command from an operand (if an operand is required), and there should be no trailing spaces after an operand. The command is required to be at least two characters long, but may be longer, i. e. CO, CON, or CONNECT will all do the same thing. The commands may be typed in upper, lower, or mixed case. Input is converted to upper case in the command processor for commands processed by the TIP. Characters entered for transmission will NOT be converted to upper case.

During command entry, use the editing charact%2s to correct errors. TNC will sound bell (assuming you have one!) if you try to back up too far. The bell will also sound in case of an invalid command or operand.

The available commands follow. Note that the minimum command is given by two capital letters. In some cases these are NOT the first two letters of the command.

Commands labeled as not yet implemented are planned for the near future. They are accepted as valid commands by the TNC, but have no effect.

CO - COnnect <call sign> :- Leave monitor mode and attempt to

link to node with specified call sign. The call sign may be up to a maximum of seven characters but may be less. Call signs less than seven characters are internally padded with blanks on the right but this is transparent to the user.

DI - DIsconnect :- If linked, unlink and return to monitor mode. No operand.

CA - CAllsign <call sign> :- Set the call sign of this node. Useful for changing the call sign of a borrowed TNC without burning new EPROMS. Operand must be 1 to 7 characters, and will be converted to upper case. The default supplied in CONFIG.LIB is VE7APU, you probably need to change it.

IN - INitialize :- Jump to reset point, same as hitting the RESET switch on front panel. No operand.

AB - ABort. Acts the same as the INitialize command. Will be changed later. No operand.

MO - MOnitor :- Jump to monitor, if one exists. Used on development TNC, does the same as hitting the TRAP switch. No operand.

DI - DIsconnect. Performs the reverse function of Connect. Causes the LIP to unlink from the link partner and return to monitor mode. This command takes no operands and is in error if a link is not established.

TR - TRansparent. This is for a future facility but is not implemented as yet.

MM - Monitor Mode. This is for a planned facility which has not been implemented as yet.

SE - SEt <decimal parameter #> <decimal value #> Set X.3 parameter values. This is an important new command which is used to set parameters which tailor the way the TNC communicates with the terminal or computer, as well as the way the LIP (datalink) and NIP (network) programs function. The default values of these parameters and their function is described in a later section of this document. The operands may be a list of parameter reference numbers and corresponding values.

PA - PAr? <decimal parameter #> Display the current value of specified parameter numbers.

MESSAGES

VADCG V-2 TIP xxxxxx

This is the initial logon message sage which should be displayed on the terminal when the TNC is reset or after the serial speed and format have been determined by the AutoBaud service signals. 'xxxxxx' represents a date when the software was last changed.

*

This is the prompt character which indicates the TNC is in command mode. The '*' prompt will only appear if command mode is permitted and prompt signals are allowed. See X.3 parameter numbers 1 and 6.

<CALLSIGN> linked RC=xx

This service message indicates that a link has been established. RC=xx indicates the value of the reason code field in the XID frame received. It will normally be 00 which indicates normal operation.

<CALLSIGN> unlinked RC=xx

This message appears after a DIsconnect command has been acted upon. Consult V-2 protocol specifications for meaning of reason codes other than 00 which is normal.

<CALLSIGN> endlink RC=xx

This message appears when a DISC frame is received from a linked node and indicates that the link is terminated. The reason code in the message is the reason code in the received DISC frame.

<CALLSIGN> no contact RC=xx

This message appears after a selected number of timeouts have occurred and the network layer has decided that communication with the other node is impossible. The link is not established.

(CALLSIGN> unknown RC=xx

This message indicates that an unknown link status code has been received from the datalink layer (LIP). This indicates a software error of some kind and should be reported to the software developer.

PAR <xx:yy>

This is a response to the 'PAR?' command and means that parameter xx is currently yy.

PAR <xx:INV>

This is a response to the 'PAR?' command and means that parameter xx does not exist.

ERROR

This message occurs when an unknown or incorrectly formatted command is entered, a parameter value is invalid or the command is not permitted at this time. Note that this message also rings the bell (beeps).

TRAP MONITOR PROGRAM

When a TRAP interrupt occurs a monitor routine in TIPTT2.ASM is entered to provide a downline dump facility for debugging purposes. In order to use the code, the TRAP interrupt line on the board must be 'debounced' with a 74LS00 IC added to the board as an engineering change. The modification is described in issue #8 of "The Packet", the newsletter of the VADCG. Once entered, this code operates completely independently of the other code in the TNC.

Upon entry, this routine pulses the SOD line on the 8085 off and on to indicate it is in control and is waiting to receive an '*' on the serial terminal interface. To make this useful, the SOD line should be set up to control a LED as described in issue #8 of "The Packet". When the program receives the asterisk "*" character, it sends all of the data in the TNC from location 0 to the highest RAM address down the serial terminal interface. This data should be captured by a program in the computer and then analysed. The source in this program is set up for a speed of 4800 Baud and is independent of the regular speed of the terminal interface. It can be changed by modifying the code in NIP.ASM.

While transmitting the dump, the SOD line will be steady, but when the dump has been sent, the SOD line will resume pulsing. The program will repeat the transfer of the data if it receives another '*' at this time. This program stores status information in the TCA (Terminal Control Area).

TRAP MONITOR COMMANDS

When the trap monitor has been entered there are four single character commands available:

'D' - This is a hexadecimal memory display command. Follow the 'D' with four hexadecimal digits representing the starting address of the memory to be displayed. 256 bytes of memory are displayed starting at the address specified. For example to display the memory locations 3100 to 31FF Hexadecimal type:

'D3100<cr>'

'H' - This changes the UART format and Baud rate to that specified in the CONFIG.LIB file. This is mainly used to change the Baud rate when it is necessary to send a complete memory dump to a host computer which operates at a different speed than the usual used terminal. Without the use of this command, the speed and format remain the same as at the time when the trap interrupt was taken.

'*' - When the * is received by the trap monitor, the entire contents of memory are sent unformatted on the serial data line. This is the command usually used by the TNCDUMP program to capture a complete memory dump from the TNC.

'R' - This command resumes execution of the program at the point where the trap interrupt was taken.

X.3 PARAMETER VALUES

* = default value
\# = not supported
% = additional to X.3 standard

REFERENCE			
1	Command escape	0	not possible
		*27	ESC character
		1-26, 28-255	optional values
2	Echo	0	no echo
		*1	echo
3	Data forwarding	0	full packet only
		1	alphanumerics
		*2	carriage return
		4	ESC, BEL, ENQ, ACK
		6	carriage return, ESC, BEL, ENQ, ACK
		8	DEL, CAN, DC2
		16	ETX, EOT
		18	carriage return, EOT, ETX
		32	HT, LF, VT, FF
		126	all other characters in col 1 & 2
4	Idle timer delay	0	no timer
		*32	approximately 20 seconds
		1-31, 33-255	delay values
5	Flow control to TNC	0	no flow control
		1	X-ON/X-OFF (data transfer)
		2	X-ON/X-OFF (data transfer and command)
		*4	CTS/RTS flow control
6	Control of TNC service sigs	0	no service signals
		1	transmit service signals
		*5	transmit service and prompt sigs
7	operation on break	*0	no action
		8	escape from data transfer state
8	discard output	*0	normal data delivery
		1	discard output to terminal
9	Carriage return padding	*0	no padding
		1-255	number of nulls inserted after CR
10	Line folding	*0	no line folding
		1-255	number of characters per line
11	Binary speed	0	110 bit/s
		1	134.5 bit/s
		2	300 bit/s
		3	1200 bit/s
		4	600 bit/s
		5	75 bit/s
		6	150 bit/s
		7	1800 bit/s
		8	200 bit/s
		9	100 bit/s
		10	50 bit/s
		#11	75/1200 bit/s
		12	2400 bit/s
		13	4800 bit/s
		14	9600 bit/s
		15	19200 bit/s
		#16	48000 bit/s
		#17	56000 bit/s
		#18	64000 bit/s

12 Flow control to terminal	*0	no flow control
	1	X-ON/X-OFF flow control
	%2	CTS/RTS flow control
13 Line feed insertion	0	None
	1	after carriage return to terminal
	2	after carriage return from terminal
	4	after echoed carriage return
	5	values 1 + 4
	*6	values 2 + 4
	7	values 1 + 2 + 4
14 Line feed padding	*0	none
	1-255	number of nulls after line feed
15 Editing	0	off
	*1	on
16 Character delete	*8	BS (backspace) character (©H)
	0-7, 9-127	other characters
17 Line delete	*21	NAK character (©U)
	0-20, 22-127	other characters
18 Line display	*18	DC2 character (©R)
	0-17, 19-127	other characters
19 Editing service signals	0	no editing service signals
	1	editing for printing terminals
	*2	editing for display terminals
	#8	editing using characters from range 32-126
20 Echo mask	*0	all characters echoed
	1	no echo of carriage return
	2	no echo of LF
	4	no echo of VT, HT, FF
	8	no echo of BEL, BS
	16	no echo of ESC, ENQ
	32	no echo of ACK, NAK, STX, SOH, EOT, ETB, ETX
	64	no echo of editing characters
	128	no echo of all characters in columns 1 & 2 plus DEL
#21 Parity treatment	#0	no parity detection or generation
	#1	parity checking
	#2	parity generation
	#3	value 1 + 2
22 Page wait	*0	no page wait
	1-255	number of line feed characters before waiting
%23 Buffer cushion	*80	number of characters in cushion
	2-79, 81-254	other values
%24 Linked timeouts	*16	maximum consecutive timeouts linked
	1-15, 17-255	other values
%25 Unlinked timeouts	*5	maximum consecutive timeouts when not linked
	1-4, 6-255	other values
%26 Line timeout	*10	approximately 10 seconds
	1-9, 11,255	other values
%27 Duplex line control	*0	no duplex line control
	1	always assume that channel is clear
%28 Clear to send delay	*32	approximately 1 second
	1-31, 33-255	other values

%29	Link control	*0	normal
		1	links to other nodes not permitted
%30	Unused link control parameter		
%31	Autobaud control	0	use UART defaults
		*1	AutoBaud
%32	Received packet forwarding	0	only pass packets when linked
		*1	pass unlinked packets
%33	Maximum packet length	*200	maximum output packet data bytes
		3-199, 201-250	other values
%34	Network header 2nd byte	*0	NH second byte is 00
		1-255	other values
%35	Unused network control parameter		
%36	Unused network control parameter		
%37	Unused network control parameter		
%38	Unused network control parameter		
%39	RLSD (CD) line control	*0	always on
		1	indicates if link is established
%40	Data mask	*127	mask off high order bit
		255	pass all 8 bits in each byte